

WHAT IS CLAIMED IS:

1. A method for use in a network management device for managing a plurality of network devices on a network, said method comprising the steps of:

detecting an address assignment message sent from an address server over the network to one of the plurality of network devices, the address assignment message containing an assigned address corresponding to the network device;

sending, in response to the detection of the address assignment message, an information request message over the network from the network management device to the network device, the information request message containing the assigned address corresponding to the network device;

receiving, in response to the information request message, information from the network device; and

creating an entry corresponding to the network device in a device management directory, the entry containing the assigned address corresponding to the network device and the information received from the network device.

2. A method according to Claim 1, wherein the plurality of network devices are network printers.

3. A method according to Claim 1, wherein the address assignment message is a DHCP message,

the address server is a DHCP server and the assigned address is an IP address.

5           4. A method according to Claim 3, wherein  
the DHCP server is disposed in the network  
management device and provides the detection of the  
address assignment message.

10           5. A method according to Claim 1, wherein  
the address assignment message is detected by a  
listening module disposed in the network management  
device.

15           6. A method according to Claim 1, wherein  
the address assignment message further contains a  
preset identification address corresponding to the  
printing device.

20           7. A method according to Claim 6, wherein  
in the sending step, the information request message  
is only sent if the preset identification address of  
the address assignment message is within a  
predetermined range of identification addresses.

25           8. A method according to Claim 6, wherein  
the preset identification address is a MAC address  
and, in the detecting step, the address assignment  
message is only detected if the MAC address is  
within a predetermined range of MAC addresses.

30           9. A method according to Claim 2, further  
comprising the step of initiating execution of a

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virtual device module corresponding to the printing device, the virtual device module for extending the functional capabilities of the printing device.

5           10. A method according to Claim 9, further comprising the step of initiating execution of a functional application module for interfacing with the virtual device module for utilizing an extended functional capability of the network device.

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          11. A method according to Claim 10, wherein the functional application module is a print job accounting application module.

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          12. A method according to Claim 10, wherein the functional application module is a print job policy management application module.

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          13. A method according to Claim 10, wherein the functional application module is a printing device management application module.

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          14. A method according to Claim 10, wherein the functional application module is a printing device driver utility.

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          15. A method according to Claim 10, wherein the functional application module is a secure print job application module.

          16. A method according to Claim 1, further comprising the step of publishing the presence of

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the network management device to a plurality of workstations on the network.

5           17. A method according to Claim 16,  
wherein the network management device is published  
as a print server for each network device having an  
entry in the device management directory.

10           18. A method according to Claim 2, further  
comprising the steps of creating a print queue for  
each printing device having an entry in the device  
management directory and publishing each respective  
print queue to a plurality of workstations on the  
network.

15           19. A method according to Claim 18,  
further comprising the steps of receiving a print  
job from one of the workstations, the print job  
being directed to one of the print queues,  
20       submitting the print job to the corresponding print  
queue, and sending the print job from the print  
queue to the printing device corresponding to the  
print queue.

25           20. A method according to Claim 1, wherein  
the network management device includes a web server  
which provides a network configuration web page for  
access by at least one workstation having a  
connection with the network management device, the  
30       network configuration web page containing a user  
interface for management of the network management

device and of each network device having an entry in the device management directory.

21. A method according to Claim 1, wherein  
5 the network management device includes a user interface panel for management of the network management device and of each network device having an entry in the device management directory.

10 22. A method according to Claim 13, wherein the printing device management application module supports a user interface display on a workstation having a connection with the network management device, the user interface for management  
15 of the network management device and of each printing device having an entry in the device management directory.

23. A method according to Claim 1, wherein  
20 the network is a local network, wherein the network management device has a first interface card which connects the network management device to the plurality of network devices via the local network, and has a second interface card which connects the  
25 network management device to a main network.

24. A method according to Claim 23,  
wherein at least one network server and at least one network computing device are connected to the main  
30 network, and wherein the network server and the network computing device can communicate with the

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via the first interface card, and is connected to the main network via the second interface card.

29. A method according to Claim 23,  
5 wherein at least one additional network management device having first and second interface cards is connected to a second plurality of network devices on a second local network via the first interface card, and is connected to the main network via the  
10 second interface card.

30. A method according to Claim 29,  
wherein each network management device sends an announcement message over the main network for  
15 detection by the other network management device, whereby each network management device detects the presence of the other network management device.

31. A method according to Claim 30,  
20 wherein one of the network management devices is designated as a master network management device and the at least one other network management device is designated as a slave network management device.

32. A method according to Claim 31,  
25 wherein the master network management device obtains a copy of the device management directory from the slave network management device.

33. A method according to Claim 32,  
30 wherein only the master network management device supports a user interface for management of the

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master network management device, the slave network management device and all network devices having entries in the respective device management directories of each network management device.

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34. A method according to Claim 32, wherein each network management device on the network supports a user interface for obtaining information and managing the particular network management device and all network devices having entries in the respective device management directories of all network management devices.

35. A method according to Claim 32, wherein the master network management device creates a combined device management directory containing entries from the device management directory of the master network management device and from the device management directory of the slave network management device.

36. A method according to Claim 35, wherein the master network management device sends a backup copy of the combined device management directory to the slave network management device.

37. A method according to Claim 36, wherein, in the case of failure of the master network management device, the slave network management device is re-designated as the master network management device.



38. A method according to Claim 28,  
wherein the network management device creates and  
maintains a plurality of print queues corresponding  
to a determined subset of the plurality of printing  
5 devices, and wherein the second network management  
device creates and maintains a plurality of print  
queues corresponding to the remaining ones of the  
plurality of printing devices.

39. A method according to Claim 38,  
wherein the determined subset is determined based on  
a resource availability indicator for each of the  
network management devices.

40. A method according to Claim 28,  
wherein the network management device instructs the  
second network management device via the main  
network to disable a capability of the second  
network management device to send and detect address  
20 assignment messages.

41. A method according to Claim 23,  
wherein a plurality of network management devices  
are connected to the main network via a first  
25 interface card in each respective network management  
device, and wherein each respective network  
management device is connected to a separate  
plurality of network devices on a separate local  
network via a second interface card.

42. A method according to Claim 41,  
wherein a designated one of the plurality of network

management devices collect information from each of the other network management devices regarding a set of functional services that each network management device supports for each of the separate plurality of network devices connected to the respective network management device.

43. A method according to Claim 42, wherein the designated network management device generates a global functional services directory based on the collected information.

44. A method according to Claim 31, wherein the master network management device collects information from the slave network management device regarding a set of functional services that the slave network management device supports for each of the plurality of network devices.

45. A method according to Claim 44, wherein the master network management device generates a local functional services directory based on the collected information from the slave network management device and based on information regarding a set of functional services that the master network management device supports for each of the plurality of network devices.

46. A method for use in a network management device for managing a plurality of

network printers on a network, said method comprising the steps of:

receiving an address request message from one of the plurality of network printers, the address request message containing a MAC address corresponding to the network printer;

sending an address assignment message from an address server in the network management device over the network to the network printer, the address assignment message containing the MAC address and an assigned IP address corresponding to the network printer;

notifying a discovery module in the network management device of the assigned IP address of the network printer;

determining, in the discovery module, if the MAC address of the network printer is within a predetermined range of MAC addresses;

sending, in the case that the MAC address of the network printer is within the predetermined range of MAC addresses, an information request message from the discovery module over the network to the network printer, the information request message containing the assigned IP address corresponding to the network printer;

receiving, in the case that the MAC address of the network printer is within the predetermined range of MAC addresses, information from the network printer in response to the information request message; and

creating, in the case that the MAC address of the network printer is within the predetermined

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range of MAC addresses, an entry corresponding to the network printer in a device management directory, the entry containing the MAC address and the assigned IP address corresponding to the network printer, and containing the information received from the network printer.

47. A network management device for managing a plurality of network devices on a network, said computing device comprising:

a program memory for storing process steps executable to perform the steps of (a) detecting an address assignment message sent from an address server over the network to one of the plurality of network devices, the address assignment message containing an assigned address corresponding to the network device, (b) sending, in response to the detection of the address assignment message, an information request message over the network from the network management device to the network device, the information request message containing the assigned address corresponding to the network device, (c) receiving, in response to the information request message, information from the network device, and (d) creating an entry corresponding to the network device in a device management directory, the entry containing the assigned address corresponding to the network device and the information received from the network device; and

a processor for executing the process steps stored in said program memory.

48. A network management device according to Claim 47, wherein the plurality of network devices are network printers.

5                   49. A network management device according to Claim 47, wherein the address assignment message is a DHCP message, the address server is a DHCP server and the assigned address is an IP address.

10                   50. A network management device according to Claim 49, wherein the DHCP server is disposed in the network management device and provides the detection of the address assignment message.

15                   51. A network management device according to Claim 47, wherein the address assignment message is detected by a listening module disposed in the network management device.

20                   52. A network management device according to Claim 47, wherein the address assignment message further contains a preset identification address corresponding to the printing device.

25                   53. A network management device according to Claim 52, wherein in the sending step, the information request message is only sent if the preset identification address of the address assignment message is within a predetermined range  
30 of identification addresses.

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54. A network management device according to Claim 52, wherein the preset identification address is a MAC address and, in the detecting step, the address assignment message is only detected if the MAC address is within a predetermined range of MAC addresses.

55. A network management device according to Claim 48, further comprising the step of initiating execution of a virtual device module corresponding to the printing device, the virtual device module for extending the functional capabilities of the printing device.

56. A network management device according to Claim 55, further comprising the step of initiating execution of a functional application module for interfacing with the virtual device module for utilizing an extended functional capability of the network device.

57. A network management device according to Claim 56, wherein the functional application module is a print job accounting application module.

58. A network management device according to Claim 56, wherein the functional application module is a print job policy management application module.

59. A network management device according to Claim 56, wherein the functional application

module is a printing device management application module.

5           60. A network management device according to Claim 56, wherein the functional application module is a printing device driver utility.

10           61. A network management device according to Claim 56, wherein the functional application module is a secure print job application module.

15           62. A network management device according to Claim 47, further comprising the step of publishing the presence of the network management device to a plurality of workstations on the network.

20           63. A network management device according to Claim 62, wherein the network management device is published as a print server for each network device having an entry in the device management directory.

25           64. A network management device according to Claim 48, further comprising the steps of creating a print queue for each printing device having an entry in the device management directory and publishing each respective print queue to a plurality of workstations on the network.

30           65. A network management device according to Claim 64, further comprising the steps of

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receiving a print job from one of the workstations,  
the print job being directed to one of the print  
queues, submitting the print job to the  
corresponding print queue, and sending the print job  
5 from the print queue to the printing device  
corresponding to the print queue.

66. A network management device according  
to Claim 47, wherein the network management device  
10 includes a web server which provides a network  
configuration web page for access by at least one  
workstation having a connection with the network  
management device, the network configuration web  
page containing a user interface for management of  
15 the network management device and of each network  
device having an entry in the device management  
directory.

67. A network management device according  
20 to Claim 47, wherein the network management device  
includes a user interface panel for management of  
the network management device and of each network  
device having an entry in the device management  
directory.

68. A network management device according  
to Claim 59, wherein the printing device management  
application module supports a user interface display  
on a workstation having a connection with the  
30 network management device, the user interface for  
management of the network management device and of

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69. A network management device according to Claim 47, wherein the network is a local network, wherein the network management device has a first interface card which connects the network management device to the plurality of network devices via the local network, and has a second interface card which connects the network management device to a main network.

70. A network management device according to Claim 69, wherein at least one network server and at least one network computing device are connected to the main network, and wherein the network server and the network computing device can communicate with the plurality of network devices only through the network management device.

71. A network management device according to Claim 69, wherein the address assignment message is a DHCP message, the address server is a DHCP server provided in the network management device, and the assigned address is a local IP address for use on the local network only.

72. A network management device according to Claim 69, wherein the plurality of network devices are network printers, and further comprising the steps of creating a print queue for each printing device having an entry in the device

5                   73. A network management device according  
to Claim 72, further comprising the steps of  
receiving a print job over the main network from one  
of the workstations, the print job being directed to  
an identified one of the print queues, submitting  
10 the print job to the identified print queue, and  
sending the print job from the identified print  
queue over the local network to the printing device  
associated with the identified print queue.

25 75. A network management device according to Claim 69, wherein at least one additional network management device having first and second interface cards is connected to a second plurality of network devices on a second local network via the first interface card, and is connected to the main network via the second interface card.

76. A network management device according to Claim 75, wherein each network management device

sends an announcement message over the main network  
for detection by the other network management  
device, whereby each network management device  
detects the presence of the other network management  
device.

77. A network management device according  
to Claim 76, wherein one of the network management  
devices is designated as a master network management  
device and the at least one other network management  
device is designated as a slave network management  
device.

78. A network management device according  
to Claim 77, wherein the master network management  
device obtains a copy of the device management  
directory from the slave network management device.

79. A network management device according  
to Claim 78, wherein only the master network  
management device supports a user interface for  
management of the master network management device,  
the slave network management device and all network  
devices having entries in the respective device  
management directories of each network management  
device.

80. A network management device according  
to Claim 78, wherein each network management device  
on the network supports a user interface for  
obtaining information and managing the particular  
network management device and all network devices

having entries in the respective device management directories of all network management devices.

5           81. A network management device according  
to Claim 78, wherein the master network management  
device creates a combined device management  
directory containing entries from the device  
management directory of the master network  
management device and from the device management  
10        directory of the slave network management device.

15           82. A network management device according  
to Claim 81, wherein the master network management  
device sends a backup copy of the combined device  
management directory to the slave network management  
device.

20           83. A network management device according  
to Claim 82, wherein, in the case of failure of the  
master network management device, the slave network  
management device is re-designated as the master  
network management device.

25           84. A network management device according  
to Claim 74, wherein the network management device  
creates and maintains a plurality of print queues  
corresponding to a determined subset of the  
plurality of printing devices, and wherein the  
second network management device creates and  
30        maintains a plurality of print queues corresponding  
to the remaining ones of the plurality of printing  
devices.

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85. A network management device according to Claim 84, wherein the determined subset is determined based on a resource availability indicator for each of the network management devices.

86. A network management device according to Claim 74, wherein the network management device instructs the second network management device via the main network to disable a capability of the second network management device to send and detect address assignment messages.

87. A network management device according to Claim 69, wherein a plurality of network management devices are connected to the main network via a first interface card in each respective network management device, and wherein each respective network management device is connected to a separate plurality of network devices on a separate local network via a second interface card.

88. A network management device according to Claim 87, wherein a designated one of the plurality of network management devices collects information from each of the other network management devices regarding a set of functional services that each network management device supports for each of the separate plurality of network devices connected to the respective network management device.

89. A network management device according  
to Claim 88, wherein the designated network  
management device generates a global functional  
services directory based on the collected  
5 information.

90. A network management device according  
to Claim 77, wherein the master network management  
device collects information from the slave network  
10 management device regarding a set of functional  
services that the slave network management device  
supports for each of the plurality of network  
devices.

91. A network management device according  
to Claim 90, wherein the master network management  
device generates a local functional services  
directory based on the collected information from  
the slave network management device and based on  
20 information regarding a set of functional services  
that the master network management device supports  
for each of the plurality of network devices.

92. Computer-executable process steps  
25 stored on a computer readable medium, said computer-  
executable process steps for managing a plurality of  
network devices on a network by a network management  
device, said computer-executable process steps  
comprising the steps of:

30 a detection step of detecting an address  
assignment message sent from an address server over  
the network to one of the plurality of network

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devices, the address assignment message containing an assigned address corresponding to the network device;

5 a sending step of sending, in response to the detection of the address assignment message, an information request message over the network from the network management device to the network device, the information request message containing the assigned address corresponding to the network  
10 device;

a receiving step of receiving, in response to the information request message, information from the network device; and

15 a creating step of creating an entry corresponding to the network device in a device management directory, the entry containing the assigned address corresponding to the network device and the information received from the network device.

20 93. Computer-executable process steps according to Claim 92, wherein the plurality of network devices are network printers.

25 94. Computer-executable process steps according to Claim 92, wherein the address assignment message is a DHCP message, the address server is a DHCP server and the assigned address is an IP address.

30 95. Computer-executable process steps according to Claim 94, wherein the DHCP server is

disposed in the network management device and provides the detection of the address assignment message.

5                    96. Computer-executable process steps  
according to Claim 92, wherein the address  
assignment message is detected by a listening module  
disposed in the network management device.

10                    97.   Computer-executable process steps  
according to Claim 92, wherein the address  
assignment message further contains a preset  
identification address corresponding to the printing  
device.

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98. Computer-executable process steps according to Claim 97, wherein in the sending step, the information request message is only sent if the preset identification address of the address assignment message is within a predetermined range of identification addresses.

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25           99. Computer-executable process steps according to Claim 97, wherein the preset identification address is a MAC address and, in the detecting step, the address assignment message is only detected if the MAC address is within a predetermined range of MAC addresses.

30                   100. Computer-executable process steps  
according to Claim 93, further comprising the step  
of initiating execution of a virtual device module



corresponding to the printing device, the virtual device module for extending the functional capabilities of the printing device.

5                   101. Computer-executable process steps  
according to Claim 100, further comprising the step  
of initiating execution of a functional application  
module for interfacing with the virtual device  
module for utilizing an extended functional  
10                   capability of the network device.

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15                   102. Computer-executable process steps  
according to Claim 101, wherein the functional  
application module is a print job accounting  
application module.

20                   103. Computer-executable process steps  
according to Claim 101, wherein the functional  
application module is a print job policy management  
application module.

25                   104. Computer-executable process steps  
according to Claim 101, wherein the functional  
application module is a printing device management  
application module.

30                   105. Computer-executable process steps  
according to Claim 101, wherein the functional  
application module is a printing device driver  
utility.

106. Computer-executable process steps according to Claim 101, wherein the functional application module is a secure print job application module.

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107. Computer-executable process steps according to Claim 92, further comprising the step of publishing the presence of the network management device to a plurality of workstations on the network.

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108. Computer-executable process steps according to Claim 107, wherein the network management device is published as a print server for each network device having an entry in the device management directory.

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109. Computer-executable process steps according to Claim 93, further comprising the steps of creating a print queue for each printing device having an entry in the device management directory and publishing each respective print queue to a plurality of workstations on the network.

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110. Computer-executable process steps according to Claim 109, further comprising the steps of receiving a print job from one of the workstations, the print job being directed to one of the print queues, submitting the print job to the corresponding print queue, and sending the print job from the print queue to the printing device corresponding to the print queue.

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111. Computer-executable process steps  
according to Claim 92, wherein the network  
management device includes a web server which  
provides a network configuration web page for access  
5 by at least one workstation having a connection with  
the network management device, the network  
configuration web page containing a user interface  
for management of the network management device and  
of each network device having an entry in the device  
10 management directory.

112. Computer-executable process steps  
according to Claim 92, wherein the network  
management device includes a user interface panel  
15 for management of the network management device and  
of each network device having an entry in the device  
management directory.

113. Computer-executable process steps  
20 according to Claim 104, wherein the printing device  
management application module supports a user  
interface display on a workstation having a  
connection with the network management device, the  
user interface for management of the network  
25 management device and of each printing device having  
an entry in the device management directory.

114. Computer-executable process steps  
according to Claim 92, wherein the network is a  
30 local network, wherein the network management device  
has a first interface card which connects the  
network management device to the plurality of

network devices via the local network, and has a second interface card which connects the network management device to a main network.

115. Computer-executable process steps according to Claim 114, wherein at least one network server and at least one network computing device are connected to the main network, and wherein the network server and the network computing device can communicate with the plurality of network devices only through the network management device.

116. Computer-executable process steps according to Claim 114, wherein the address assignment message is a DHCP message, the address server is a DHCP server provided in the network management device, and the assigned address is a local IP address for use on the local network only.

117. Computer-executable process steps according to Claim 114, wherein the plurality of network devices are network printers, and further comprising the steps of creating a print queue for each printing device having an entry in the device management directory and publishing each respective print queue to a plurality of workstations on the main network.

118. Computer-executable process steps according to Claim 117, further comprising the steps of receiving a print job over the main network from one of the workstations, the print job being

directed to an identified one of the print queues,  
submitting the print job to the identified print  
queue, and sending the print job from the identified  
print queue over the local network to the printing  
5 device associated with the identified print queue.

119. Computer-executable process steps  
according to Claim 114, wherein a second network  
management device having first and second interface  
10 cards is connected to the plurality of network  
devices on the local network via the first interface  
card, and is connected to the main network via the  
second interface card.

120. Computer-executable process steps  
according to Claim 114, wherein at least one  
additional network management device having first  
and second interface cards is connected to a second  
plurality of network devices on a second local  
20 network via the first interface card, and is  
connected to the main network via the second  
interface card.

121. Computer-executable process steps  
25 according to Claim 120, wherein each network  
management device sends an announcement message over  
the main network for detection by the other network  
management device, whereby each network management  
device detects the presence of the other network  
30 management device.

122. Computer-executable process steps  
according to Claim 121, wherein one of the network  
management devices is designated as a master network  
management device and the at least one other network  
management device is designated as a slave network  
management device.

123. Computer-executable process steps  
according to Claim 122, wherein the master network  
management device obtains a copy of the device  
management directory from the slave network  
management device.

124. Computer-executable process steps  
according to Claim 123, wherein only the master  
network management device supports a user interface  
for management of the master network management  
device, the slave network management device and all  
network devices having entries in the respective  
device management directories of each network  
management device.

125. Computer-executable process steps  
according to Claim 123, wherein each network  
management device on the network supports a user  
interface for obtaining information and managing the  
particular network management device and all network  
devices having entries in the respective device  
management directories of all network management  
devices.

126. Computer-executable process steps according to Claim 123, wherein the master network management device creates a combined device management directory containing entries from the device management directory of the master network management device and from the device management directory of the slave network management device.

127. Computer-executable process steps according to Claim 126, wherein the master network management device sends a backup copy of the combined device management directory to the slave network management device.

128. Computer-executable process steps according to Claim 127, wherein, in the case of failure of the master network management device, the slave network management device is re-designated as the master network management device.

129. Computer-executable process steps according to Claim 119, wherein the network management device creates and maintains a plurality of print queues corresponding to a determined subset of the plurality of printing devices, and wherein the second network management device creates and maintains a plurality of print queues corresponding to the remaining ones of the plurality of printing devices.

130. Computer-executable process steps according to Claim 129, wherein the determined

subset is determined based on a resource availability indicator for each of the network management devices.

5                   131. Computer-executable process steps  
according to Claim 119, wherein the network  
management device instructs the second network  
management device via the main network to disable a  
10                   capability of the second network management device  
to send and detect address assignment messages.

15                   132. Computer-executable process steps  
according to Claim 114, wherein a plurality of  
network management devices are connected to the main  
network via a first interface card in each  
respective network management device, and wherein  
each respective network management device is  
connected to a separate plurality of network devices  
on a separate local network via a second interface  
20                   card.

25                   133. Computer-executable process steps  
according to Claim 132, wherein a designated one of  
the plurality of network management devices collects  
information from each of the other network  
management devices regarding a set of functional  
services that each network management device  
supports for each of the separate plurality of  
network devices connected to the respective network  
30                   management device.



134. Computer-executable process steps according to Claim 133, wherein the designated network management device generates a global functional services directory based on the collected information.

135. Computer-executable process steps according to Claim 122, wherein the master network management device collects information from the slave network management device regarding a set of functional services that the slave network management device supports for each of the plurality of network devices.

136. Computer-executable process steps according to Claim 135, wherein the master network management device generates a local functional services directory based on the collected information from the slave network management device and based on information regarding a set of functional services that the master network management device supports for each of the plurality of network devices.

137. A computer-readable medium which stores computer-executable process steps, the computer-executable process steps to manage a plurality of network devices on a network by a network management device, said computer-executable process steps comprising:

a detection step of detecting an address assignment message sent from an address server over

the network to one of the plurality of network devices, the address assignment message containing an assigned address corresponding to the network device;

5           a sending step of sending, in response to the detection of the address assignment message, an information request message over the network from the network management device to the network device, the information request message containing the  
10       assigned address corresponding to the network device;

          a receiving step of receiving, in response to the information request message, information from the network device; and

15           a creating step of creating an entry corresponding to the network device in a device management directory, the entry containing the assigned address corresponding to the network device and the information received from the network  
20       device.

138. A computer-readable medium according to Claim 137, wherein the plurality of network devices are network printers.

25           139. A computer-readable medium according to Claim 137, wherein the address assignment message is a DHCP message, the address server is a DHCP server and the assigned address is an IP address.

30           140. A computer-readable medium according to Claim 139, wherein the DHCP server is disposed in

the network management device and provides the detection of the address assignment message.

5           141. A computer-readable medium according to Claim 137, wherein the address assignment message is detected by a listening module disposed in the network management device.

10           142. A computer-readable medium according to Claim 137, wherein the address assignment message further contains a preset identification address corresponding to the printing device.

15           143. A computer-readable medium according to Claim 142, wherein in the sending step, the information request message is only sent if the preset identification address of the address assignment message is within a predetermined range of identification addresses.

20           144. A computer-readable medium according to Claim 142, wherein the preset identification address is a MAC address and, in the detecting step, the address assignment message is only detected if  
25           the MAC address is within a predetermined range of MAC addresses.

30           145. A computer-readable medium according to Claim 138, further comprising the step of initiating execution of a virtual device module corresponding to the printing device, the virtual

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device module for extending the functional capabilities of the printing device.

5           146. A computer-readable medium according to Claim 145, further comprising the step of initiating execution of a functional application module for interfacing with the virtual device module for utilizing an extended functional capability of the network device.

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          147. A computer-readable medium according to Claim 146, wherein the functional application module is a print job accounting application module.

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          148. A computer-readable medium according to Claim 146, wherein the functional application module is a print job policy management application module.

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          149. A computer-readable medium according to Claim 146, wherein the functional application module is a printing device management application module.

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          150. A computer-readable medium according to Claim 146, wherein the functional application module is a printing device driver utility.

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          151. A computer-readable medium according to Claim 146, wherein the functional application module is a secure print job application module.

152. A computer-readable medium according to Claim 137, further comprising the step of publishing the presence of the network management device to a plurality of workstations on the network.

153. A computer-readable medium according to Claim 152, wherein the network management device is published as a print server for each network device having an entry in the device management directory.

154. A computer-readable medium according to Claim 138, further comprising the steps of creating a print queue for each printing device having an entry in the device management directory and publishing each respective print queue to a plurality of workstations on the network.

155. A computer-readable medium according to Claim 154, further comprising the steps of receiving a print job from one of the workstations, the print job being directed to one of the print queues, submitting the print job to the corresponding print queue, and sending the print job from the print queue to the printing device corresponding to the print queue.

156. A computer-readable medium according to Claim 137, wherein the network management device includes a web server which provides a network configuration web page for access by at least one

workstation having a connection with the network management device, the network configuration web page containing a user interface for management of the network management device and of each network device having an entry in the device management directory.

157. A computer-readable medium according to Claim 137, wherein the network management device includes a user interface panel for management of the network management device and of each network device having an entry in the device management directory.

158. A computer-readable medium according to Claim 149, wherein the printing device management application module supports a user interface display on a workstation having a connection with the network management device, the user interface for management of the network management device and of each printing device having an entry in the device management directory.

159. A computer-readable medium according to Claim 137, wherein the network is a local network, wherein the network management device has a first interface card which connects the network management device to the plurality of network devices via the local network, and has a second interface card which connects the network management device to a main network.

160. A computer-readable medium according to Claim 159, wherein at least one network server and at least one network computing device are connected to the main network, and wherein the network server and the network computing device can communicate with the plurality of network devices only through the network management device.

161. A computer-readable medium according to Claim 159, wherein the address assignment message is a DHCP message, the address server is a DHCP server provided in the network management device, and the assigned address is a local IP address for use on the local network only.

162. A computer-readable medium according to Claim 159, wherein the plurality of network devices are network printers, and further comprising the steps of creating a print queue for each printing device having an entry in the device management directory and publishing each respective print queue to a plurality of workstations on the main network.

163. A computer-readable medium according to Claim 162, further comprising the steps of receiving a print job over the main network from one of the workstations, the print job being directed to an identified one of the print queues, submitting the print job to the identified print queue, and sending the print job from the identified print

queue over the local network to the printing device associated with the identified print queue.

164. A computer-readable medium according to Claim 159, wherein a second network management device having first and second interface cards is connected to the plurality of network devices on the local network via the first interface card, and is connected to the main network via the second interface card.

165. A computer-readable medium according to Claim 159, wherein at least one additional network management device having first and second interface cards is connected to a second plurality of network devices on a second local network via the first interface card, and is connected to the main network via the second interface card.

166. A computer-readable medium according to Claim 165, wherein each network management device sends an announcement message over the main network for detection by the other network management device, whereby each network management device detects the presence of the other network management device.

167. A computer-readable medium according to Claim 166, wherein one of the network management devices is designated as a master network management device and the at least one other network management



device is designated as a slave network management device.

5           168. A computer-readable medium according to Claim 167, wherein the master network management device obtains a copy of the device management directory from the slave network management device.

10           169. A computer-readable medium according to Claim 168, wherein only the master network management device supports a user interface for management of the master network management device, the slave network management device and all network devices having entries in the respective device  
15 management directories of each network management device.

20           170. A computer-readable medium according to Claim 168, wherein each network management device on the network supports a user interface for obtaining information and managing the particular network management device and all network devices having entries in the respective device management  
25 directories of all network management devices.

30           171. A computer-readable medium according to Claim 168, wherein the master network management device creates a combined device management directory containing entries from the device management directory of the master network management device and from the device management directory of the slave network management device.

172. A computer-readable medium according to Claim 171, wherein the master network management device sends a backup copy of the combined device management directory to the slave network management device.

173. A computer-readable medium according to Claim 172, wherein, in the case of failure of the master network management device, the slave network management device is re-designated as the master network management device.

174. A computer-readable medium according to Claim 164, wherein the network management device creates and maintains a plurality of print queues corresponding to a determined subset of the plurality of printing devices, and wherein the second network management device creates and maintains a plurality of print queues corresponding to the remaining ones of the plurality of printing devices.

175. A computer-readable medium according to Claim 174, wherein the determined subset is determined based on a resource availability indicator for each of the network management devices.

176. A computer-readable medium according to Claim 164, wherein the network management device instructs the second network management device via the main network to disable a capability of the

second network management device to send and detect address assignment messages.

5           177. A computer-readable medium according to Claim 159, wherein a plurality of network management devices are connected to the main network via a first interface card in each respective network management device, and wherein each respective network management device is connected to  
10 a separate plurality of network devices on a separate local network via a second interface card.

15           178. A computer-readable medium according to Claim 177, wherein a designated one of the plurality of network management devices collects information from each of the other network management devices regarding a set of functional services that each network management device supports for each of the separate plurality of  
20 network devices connected to the respective network management device.

25           179. A computer-readable medium according to Claim 178, wherein the designated network management device generates a global functional services directory based on the collected information.

30           180. A computer-readable medium according to Claim 167, wherein the master network management device collects information from the slave network management device regarding a set of functional

services that the slave network management device supports for each of the plurality of network devices.

5           181. A computer-readable medium according to Claim 180, wherein the master network management device generates a local functional services directory based on the collected information from the slave network management device and based on  
10 information regarding a set of functional services that the master network management device supports for each of the plurality of network devices.

15           182. A network management device for managing a plurality of network printers on a network, said computing device comprising:

          a program memory for storing process steps executable to perform the steps of (a) receiving an address request message from one of the plurality of  
20 network printers, the address request message containing a MAC address corresponding to the network printer, (b) sending an address assignment message from an address server in the network management device over the network to the network  
25 printer, the address assignment message containing the MAC address and an assigned IP address corresponding to the network printer, (c) notifying a discovery module in the network management device of the assigned IP address of the network printer,  
30 (d) determining, in the discovery module, if the MAC address of the network printer is within a predetermined range of MAC addresses, (e) sending,

in the case that the MAC address of the network printer is within the predetermined range of MAC addresses, an information request message from the discovery module over the network to the network printer, the information request message containing the assigned IP address corresponding to the network printer, (f) receiving, in the case that the MAC address of the network printer is within the predetermined range of MAC addresses, information from the network printer in response to the information request message, and (g) creating, in the case that the MAC address of the network printer is within the predetermined range of MAC addresses, an entry corresponding to the network printer in a device management directory, the entry containing the MAC address and the assigned IP address corresponding to the network printer, and containing the information received from the network printer; and

a processor for executing the process steps stored in said program memory.

183. Computer-executable process steps stored on a computer readable medium, said computer-executable process steps for managing a plurality of network printers on a network by a network management device, said computer-executable process steps comprising the steps of:

a first receiving step of receiving an address request message from one of the plurality of network printers, the address request message

containing a MAC address corresponding to the network printer;

5 a first sending step of sending an address assignment message from an address server in the network management device over the network to the network printer, the address assignment message containing the MAC address and an assigned IP address corresponding to the network printer;

10 a notifying step of notifying a discovery module in the network management device of the assigned IP address of the network printer;

15 a determining step of determining, in the discovery module, if the MAC address of the network printer is within a predetermined range of MAC addresses;

20 a second sending step of sending, in the case that the MAC address of the network printer is within the predetermined range of MAC addresses, an information request message from the discovery module over the network to the network printer, the information request message containing the assigned IP address corresponding to the network printer;

25 a second receiving step of receiving, in the case that the MAC address of the network printer is within the predetermined range of MAC addresses, information from the network printer in response to the information request message; and

30 a creating step of creating, in the case that the MAC address of the network printer is within the predetermined range of MAC addresses, an entry corresponding to the network printer in a device management directory, the entry containing

the MAC address and the assigned IP address corresponding to the network printer, and containing the information received from the network printer.

5                   184. A computer-readable medium which stores computer-executable process steps, the computer-executable process steps to manage a plurality of network printers on a network by a network management device, said computer-executable  
10 process steps comprising:

                  a first receiving step of receiving an address request message from one of the plurality of network printers, the address request message containing a MAC address corresponding to the  
15 network printer;

                  a first sending step of sending an address assignment message from an address server in the network management device over the network to the network printer, the address assignment message  
20 containing the MAC address and an assigned IP address corresponding to the network printer;

                  a notifying step of notifying a discovery module in the network management device of the assigned IP address of the network printer;

25                   a determining step of determining, in the discovery module, if the MAC address of the network printer is within a predetermined range of MAC addresses;

30                   a second sending step of sending, in the case that the MAC address of the network printer is within the predetermined range of MAC addresses, an information request message from the discovery

